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Program	B-Tech Civil
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Q No 1

(a) Ans Seismic Waves:-

Waves that transmit the energy released by an earthquake. Seismic waves are produced when some form of energy stored in earth's crust is suddenly released. Earthquake waves is known as seismic ways.

Types of seismic waves:-

Earthquake shaking and damage is the result of two basic types of elastic waves. They are:

(1) Body Waves:-

(2) Surface Waves:-

Body Waves

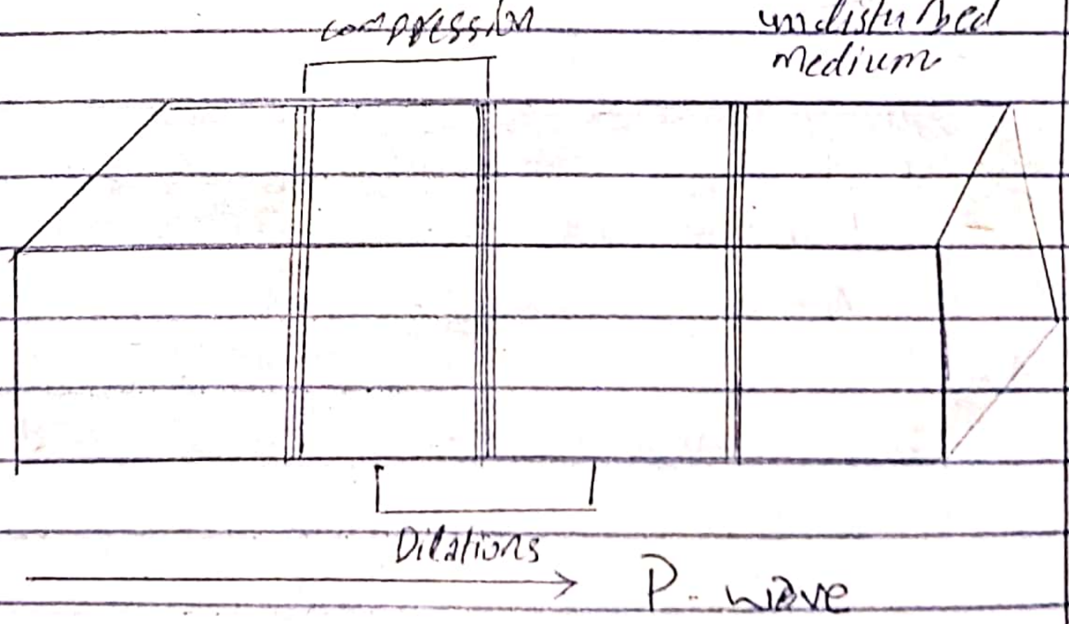
According to name of the waves which is given to the waves we understand that the Body waves are can propagate / travel through the earth's inner layers. It ~~can~~ is also subdivides in to two types.

(i) P-Waves:

(ii) S-Waves:

P-Waves

They propagate within a body of rock. The faster of these body waves is called the primary or P-waves. It's motion is the same as they that of a sound wave in that. as it spreads out, it alternately pushes (compresses) and pulls (dilates) the rock. These P waves are able to travel through both solid rock, such as granite mountains, and liquid materials such as volcanic magma or the water of the oceans.



S-Waves

The slower wave through the body of rock is called the secondary or S-waves. As an S-wave propagates, it shears the rock sideways at right angles to the direction of travel. If a liquid is sheared sideways or twisted, it will not spring back, hence S waves can-not propagate in the liquid parts of the earth such as oceans and lakes

Surface Waves

Surface waves can only move along the surface of the planet like ripples on water.

This type of wave is also sub-divided into two types

(i) Love Waves
(ii) Rayleigh Waves.

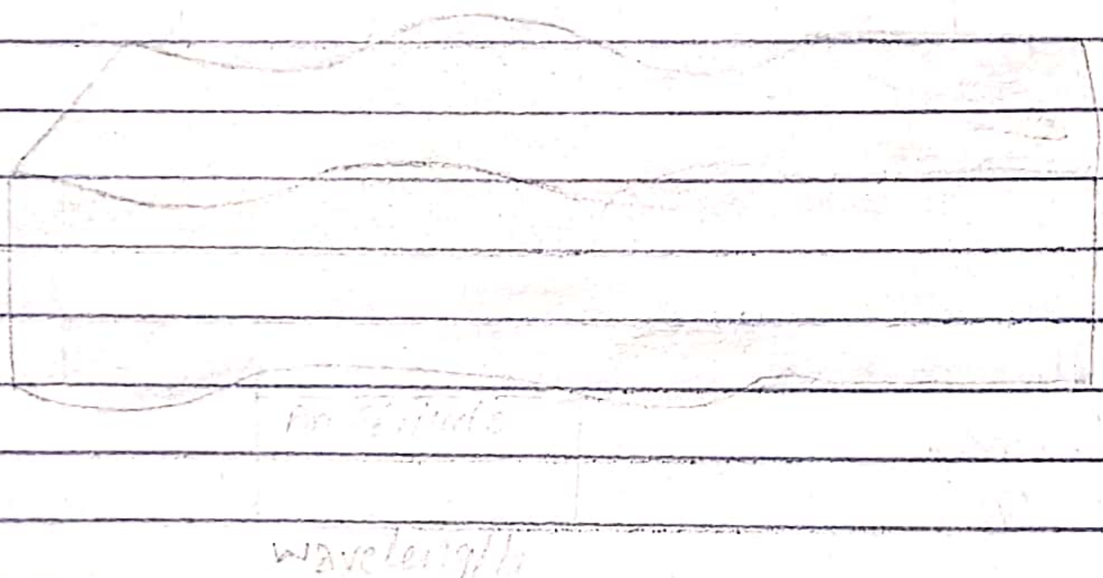
Love Waves

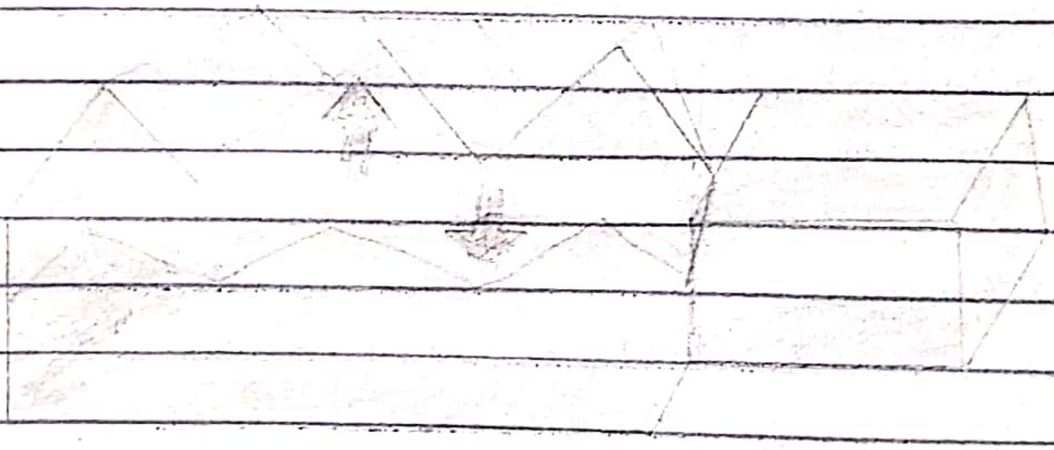
It's motion is essentially that of S waves that have no vertical displacement; it moves the ground from side to side in a horizontal shaking of love waves is particularly damaging to the foundations of structures

Rayleigh Waves

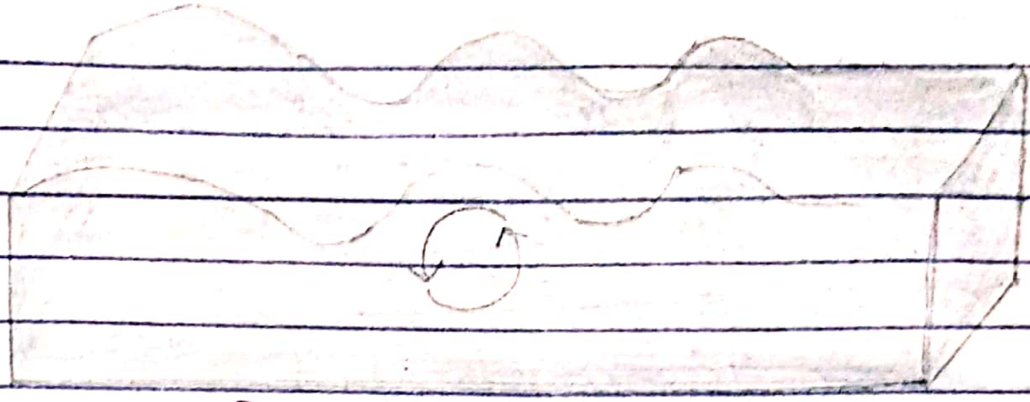
Like rolling ocean waves, Rayleigh waves waves move both vertically and horizontally in a vertical plane pointed in the direction in which the waves are travelling.

S-wave::





Love-Wave



Rayleigh Waves

(15)
↑Primary waves are faster than secondary waves?
The actual speed of P and S seismic waves depends on the density and elastic properties of the rocks and soil through which they pass. In most earthquakes the P-waves are fell faster first. The effect is similar to a sonic boom that bumps and rattles windows. Some second later the S-waves arrive with their up and down and side-to-side motion, shaking the ground surface vertically and horizontally. This is the wave motion that is so damaging to structures.

(b) Seismic Risk:-
Seismic risk refers to the risk of damage from earthquake to a building, system or other entity. Sesmic risk has been defined for most managment purposes as the potential economic, social and environmental consequences of hazardous

events that may occur in a specified period of time.
Seismic risk directly depends upon
Seismic Hazard
Seismic Vulnerability
Exposure of elements at risk
Seismic Hazard
Depend upon the geology of site and therefore cannot be controlled
Seismic Vulnerability
Belong to structures and can therefore be reduced by appropriate design and construction.

The seismic risk keep on increasing:
The current building stock is enlarged by the addition of new buildings, many with significant or even excessive, earthquake vulnerability. This above all to due to the fact that for new buildings the basic principles of earthquake resistant design and also the earthquake specifications of the buildings codes are often not followed.
The reason is either unawareness, convenience or intentional ignorance.
As a result the, the earthquake risk continues to increase unnecessarily

Urgent action needed to minimized the seismic risk.

The preceding remarks clearly illustrate that there is a large deficit in the structural measures for seismic protection in many parts of the world.

New buildings must be designed to be reasonabley earthquake resistant to prevent the constant addition of new vulnerable structures to a building stock that is already seriously threatened.

Your course "Introduction to earthquake Engineering" aims at conveying the fundamental knowledge to the civil engineers regardings seismic resistant design and construction of structures.

Q 3

Ans. Effect of shear wall arrangement on the torsional resistance of building

Effect of share walls arrangement on torsional resistance (the same total length of longitudinal wall is distributed in a different way for each layout.

→ Greatest torsional resistance is obtained by concentrating the longitudinal walls at the corners of the building, as in Fig(a). The center of rigidity is at the center of the plan (from symmetry) and the longitudinal walls, being placed as distant as possible from this center, produce the greatest torsional resistance.

→ Although the position of the center of rigidity of the symmetrical arrangement in fig(b) remains at the center of the plan the longitudinal walls are not entirely placed at the extremities thus resulting in a reduced torsional resistance.

→ Because of lack of symmetry about one axis in fig(c), the center of rigidity will move slightly off centroidal axis and lateral forces will have an increased torsional effect due to this

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offset of the center of rigidity. Also the distances from the center of rigidity of the flanged sections created with longitudinal walls have been reduced thus reducing the torsional resistance.

→ Although the arrangement of wall in ~~in~~ in ~~Fig~~ Fig (d), is symmetrical, the longitudinal walls have been moved close to the center of rigidity and the sections produced have a greatly reduced influence on the torsional resistance of the total arrangement.

→ A very poor arrangement of longitudinal walls is shown in Fig (e). Here they are clustered toward one corner, displacing the center of rigidity a large distance from the center of the plan and greatly increasing the torsional effects of the lateral loads. In addition, the longitudinal walls are at a short distance from the center of rigidity and therefore contribute less to the overall torsional resistance.

Q2

(a) Soft Story effect:-

In shaking of a building, an earthquake ground motion will search for every structural weakness. These weaknesses are usually created by sharp changes in stiffness, strength and/or ductility, and the effects of these weakness are accentuated by poor distribution of reactive masses severe structural damage suffered by several modern buildings during recent earthquakes illustrates the important of avoiding sudden changes in laterals stiffness and strength. A typical example of the detrimental effects that these discontinuities can induce is seen in the case of buildings with a "soft story".

A soft story also known as a weak story is defined as a story in a buildings that has substantially less resistance, or stiffness, than the stories above it. In essence, a soft story has inadequates shear resistance or inadequately ductility (energy absorption capacity) to resist the earthquake-induced building stresses

According to the following diagram: we can minimized the soft story effect by adding some extra structure compotent to provide extra forces and increase their stiffness and dutility and increase their resistance against earthquake.

In the following diagrame we can add some column or add bracing or add external buttresses to minimized the soft story effect in the buildings

(b) What are the various mechanisms adopted to dissipate energy imparted to a structure by earthquake?

Ans There are two mechanism which dissipate energy imparted to a structure by earthquake: They are:

1 Base Isolation:
2 Seismic Dampers

(1) Base Isolation:-

Base Isolation also known as seismic base isolation or base isolation system is one of the most popular means of protecting a structure against earthquake forces. It is a collection of structural elements which should substantially decouple a superstructure from its substructure resting on a shaking ground thus protecting a building ~~on~~ or non-building structure's integrity. Base isolation system consists of isolation units with or without isolation components, where

- Isolation units are the basic elements of a base isolation system which are intended to provide the aforementioned decoupling effect to a building or non-building structure.
- Isolation components are the connections between isolation units and their parts having no decoupling effect of their own.

Types of Base Isolation

(i) Laminated Rubber Bearing (LRB).
(ii) Spherical Isolation Sliding Bearing.

(2) Seismic Dampers:-

Another method for controlling seismic damage in buildings is the installation of seismic dampers. In this case the dampening is provided by a lead-based device.

Ground movement forces the lead to pass through a narrow gap. When the direction of movement changes, the flow of lead is reversed. The principle is still the same as the lead rubber bearing, with kinetic energy being converted into heat energy there by, preventing the building absorbing the kinetic energy.

Types of Seismic Dampers:-

There are three types of seismic dampers-

(i) Viscous Dampers
(ii) Friction Dampers
(iii) Yielding Dampers


Thank
you